

5250-3, Vol. I
Photovoltaics Program
Technology Development and Applications
Lead Center

Photovoltaic System Criteria Documents

Volume I: Guidelines for Evaluating the Management and
Operations Planning of Photovoltaic Applications

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(NASA-CR-183316) PHOTOVOLTAIC SYSTEM
CRITERIA DOCUMENTS. VOLUME 1: GUIDELINES FOR
EVALUATING THE MANAGEMENT AND OPERATIONS
PLANNING OF PHOTOVOLTAIC APPLICATIONS (JPL)
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SECTION I

INTRODUCTION

A. GENERAL INFORMATION

1. Purpose

This document provides guidelines to the Field Centers for organization, scheduling, project and cost control, and performance in the areas of project management and operations planning for Photovoltaics Test and Applications. These guidelines may be used in organizing a T&A Project Team for system design/test, site construction and operation, and as the basis for evaluating T&A proposals.

This document describes the attributes for project management and operations planning to be used by the Field Centers. Specifically, all project management and operational issues affecting costs, schedules and performance of photovoltaic systems are addressed. Other volumes referenced in this "top" document provide guidelines/criteria for design reviews; environmental and siting; quality assurance; safety; proposal evaluation; information reporting (site audit); and assessment (report card).

2. Scope

These guidelines apply to all photovoltaic system design/test and applications initiated under the auspices of the National Photovoltaic Research, Development and Demonstration Act of 1978 (PL95-590) as implemented by the DOE Photovoltaics Multiyear Program Plan (MYPP).

Photovoltaic tests and applications include residential, intermediate load center, central station, and stand-alone systems. The sub-categories of system maturity considered are: Initial System Evaluation Experiments (ISEE), System Readiness Experiments (SRE), and Commercial Readiness Demonstration Projects (CRDP) as defined in the MYPP.

This document is divided into three major sections:

Section I sets forth document purpose and scope.

Section II presents the guidelines for evaluating the project management structure and planning. This section addresses the key attributes that are expected to be contained in the management plan showing how activities are to be organized, directed and controlled.

Section III provides guidelines for evaluating the technical approach to be applied. This section addresses those key attributes that would be included in a technical plan identifying the level of technology required by a

system description and conceptual design, discussion of the analytical methods used to optimize the design, and a presentation of the functional requirements of the various subsystems.

The management and technical sections are related through the work breakdown structure, master schedule and the organization structure.

3. Objective

The hierarchy of criteria and attributes for assessing a solar PV power system is shown in Figure 1-1. The program goals of minimizing cost and negative impacts and maximizing performance and commercial potential are facilitated by this document and other guideline/criteria documents referenced herein.

4. Guidelines and Criteria Documents

- A. QUALITY ASSURANCE CRITERIA - Contains features to be considered in establishing a QA program for PV & PV/T system buildup and installation. Features items to which a QA structure is responsible for being attentive: Equipment/safety practices; defects reporting and correction; drawing and changes control; procurement source control; source inspection; all inspection and test; failure reporting.
- B. SITE AUDIT CRITERIA - Contains criteria for assessing/evaluating the success of an operational application. It suggests the minimum types of audit information to be gathered, how to classify them and how the information should be reported for system performance evaluation. Emphasis is on information needed to judge failure rates; lifecycle costs; levelized energy costs; plant reliability; environmental and safety effects; and application flexibility.
- C. ENVIRONMENTAL AND SITING CRITERIA - Contains criteria against which to judge the adequacy of environmental analysis underlying all proposed system application experiments. Potential environmental issues affecting site selection, installation, and operation of PV & PV/T systems are addressed. Considerations are offered for environmental impacts on system performance as well as system impact on the environment.
- D. DATA REQUIREMENTS - Defines the data needs and analysis procedures in the technical and non-technical areas of PV & PV/T applications. It defines measurement accuracies and sampling frequencies.
- E. DATA ACQUISITION, REDUCTION, AND DISSEMINATION CRITERIA - States requirements for the design, implementation and operation of data requisition and processing and dissemination systems.

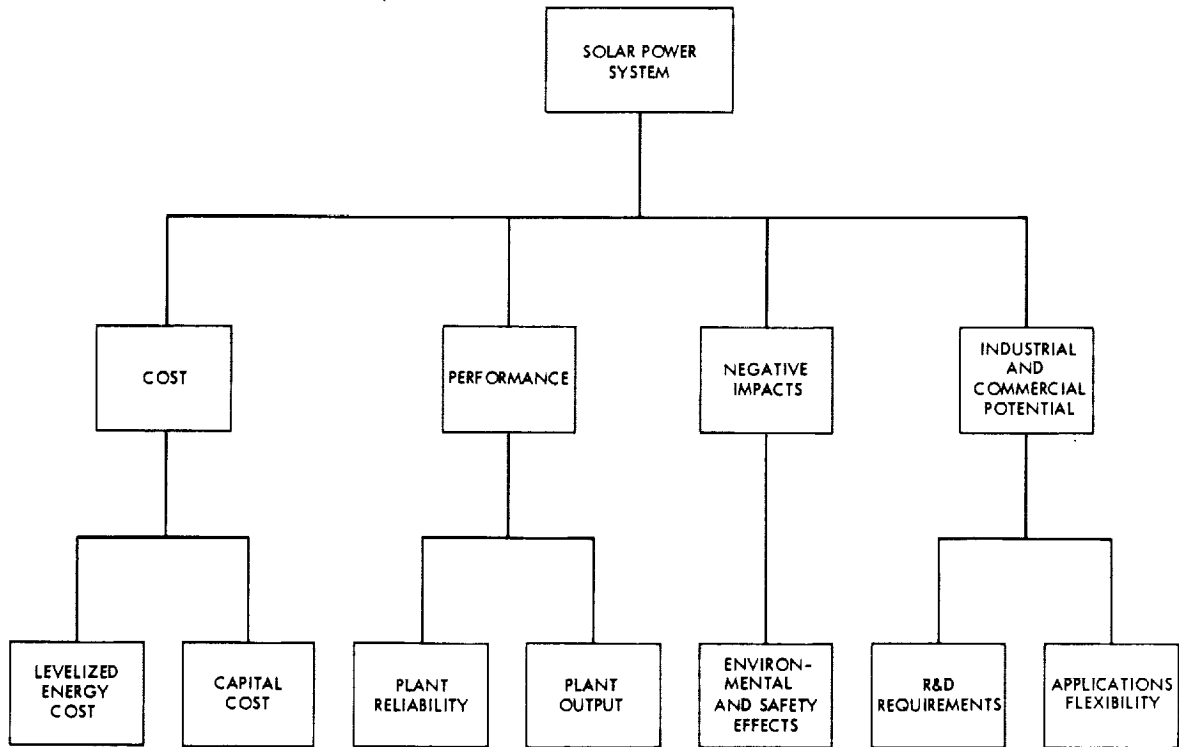


Figure 1-1. Hierarchy of Criteria and Attributes for Assessing Solar Photovoltaic Electric Power Systems Applications.

- F. USER INFORMATION REQUIREMENTS - Defines information user community and data/information elements to be acquired during systems application experiments.
- G. SAFETY CRITERIA - Describes many of the potential safety hazards involved in the construction and operation of photovoltaic power systems, and discusses safety considerations in the specification and design of photovoltaic projects.
- H. TESTS AND APPLICATIONS ASSESSMENT CRITERIA - Provides a method for assessing the success achieved by both in absolute terms and relative to other comparable experiments. Can be used in proposal evaluation.
- I. DESIGN REVIEW CRITERIA - Provides guidelines for Field Centers for the organization, preparation and conduct of program reviews.



SECTION II

GUIDELINES FOR EVALUATION OF PROJECT MANAGEMENT STRUCTURE

A. MANAGEMENT PLAN

The contractor will provide a management plan showing the organization and identification of responsibilities of team members, a work breakdown structure identifying responsibilities of team members for each task, control methods used to maintain project within cost and schedule requirements including reporting procedures for project management (internal and external) and a detailed milestone chart.

B. ORGANIZATION

The contractor's project organization will be identified, showing the reporting structure and responsibility level for the project management, the relationship of the program to the parent organization, and the program organization structures for Tests and Applications (T&A) development and implementation. The interrelationships of subcontractors and/or other organizations will be identified as applicable. The organization will show transition from one phase to the next with a continuity structure shown throughout the project.

Organization structures will be shown in chart form particularly for:

- T&A design/development
- Fabrication and installation
- Operations and evaluation.

The charts should identify reporting levels and correlate with an associated definition of responsibilities. Interrelationships will be identified both for within the contractor's organization and for interfaces with any subcontractors, associate contractors or other agencies. The organization structures should show continuity up through the project management structure. Figures 2-1, 2-2, and 2-3 show typical organization charts that would be included in the management plan.

C. RESPONSIBILITIES

Role statements will be prepared for the various reporting levels defined on the organization charts for both contractor personnel (internal) and subcontractor personnel or other agencies (external). The role statement will include reporting, charters, responsibilities and duties, management relationships and other arrangements peculiar to an individual task. The major responsibilities will be listed and any interfaces with subcontractors or other agencies will be specified.

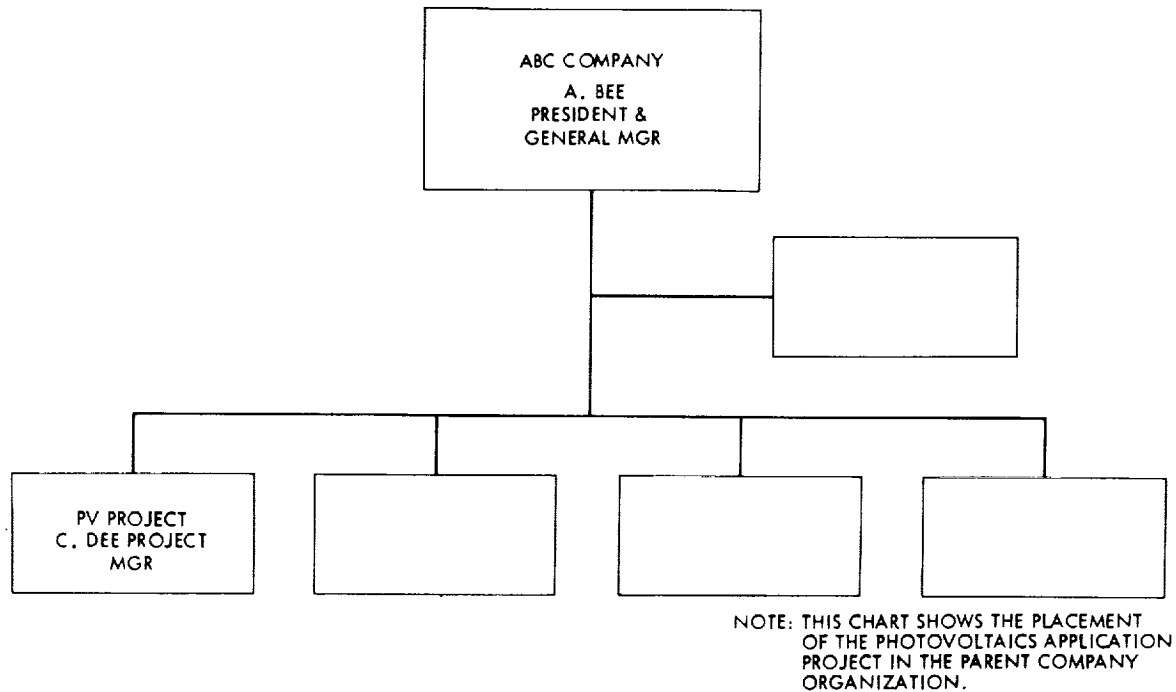


Figure 2-1. Parent Corporation Organization Structure.

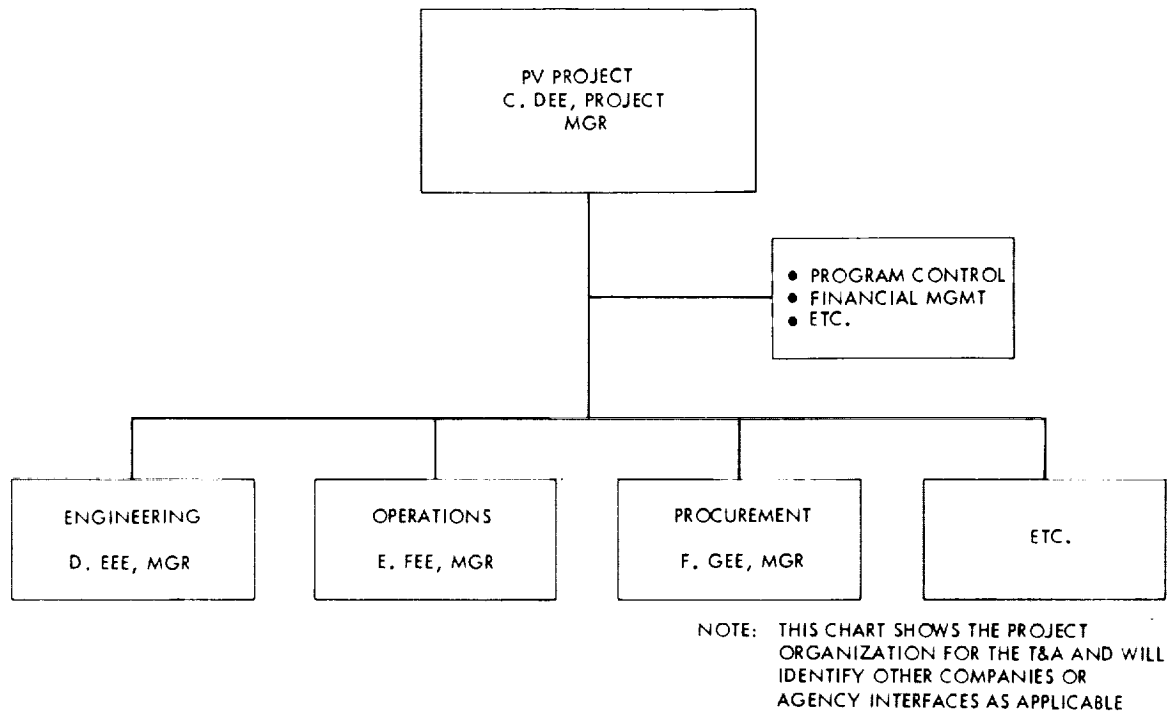
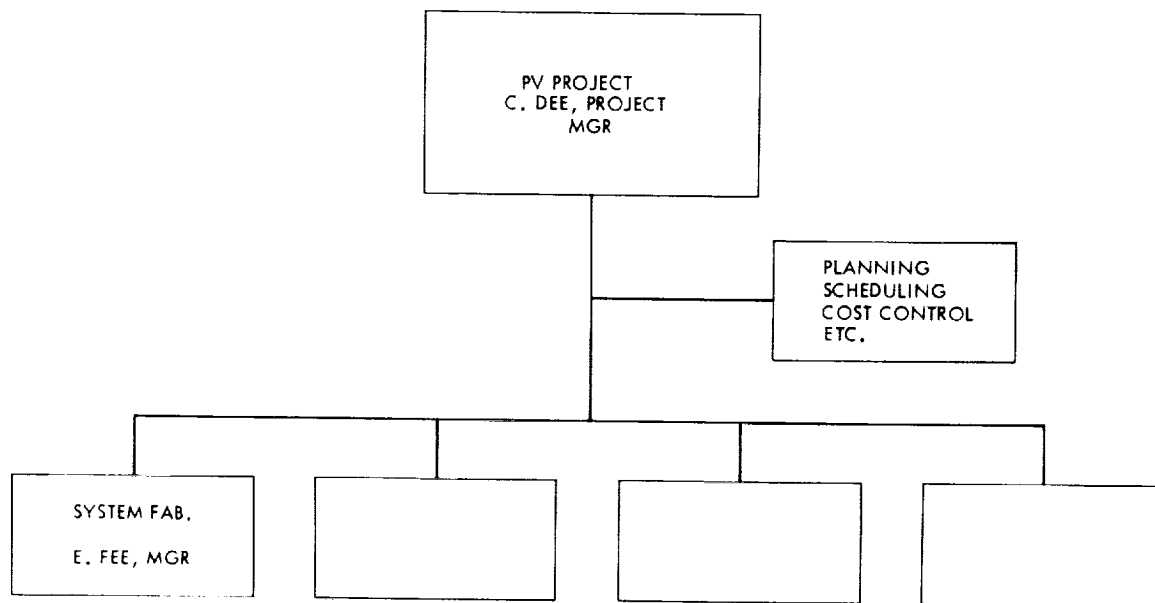


Figure 2-2. P/V Project Organization.



NOTE: ANOTHER TYPICAL CHART WOULD SHOW THE OPERATIONS AND EVALUATION ORGANIZATION.

Figure 2-3. Phase X Project Organization:
System Fabrication and Installation.

D. MANAGEMENT CONTROLS

The contractor project manager is responsible for assuring that the project objectives are organized and integrated in such a manner that the overall program goals are met; communicating the objectives throughout the management structure; and ensuring that the contract/agreement objectives are accomplished within the funds, manpower, and schedule, and to the level of performance negotiated with the field center.

1. Program Control

Program control can be accomplished by several different methods to define contract objectives, viz, Work Breakdown Structure, Cost Element, Organization/Function and Contract Line Item. The Work Breakdown Structure (WBS) is the preferred method and will be used for all T&A contracts. All baseline plans and status reports will use the WBS index number to provide consistency in reporting such that all cost, manpower, schedule and performance information can be analyzed and integrated for program management assessment.

a. Work Breakdown Structure. Program control will be based on WBS-related task descriptions using flow charts (viz; GANTT, PERT/CPM, etc.) and fiscal plans (manpower, cost, etc). Each task should be described in sufficient detail to completely define its scope. Further division of each task into subtasks should be accomplished to provide enough visibility into the individual activities to understand the interrelationship among subtasks and among other system activities.

The WBS is developed by starting with the overall objective in the contract statement of work and working down through successive levels to the lowest level of detail required for effective program management. The contractor shall provide a complete contract Work Breakdown Structure in the Management Plan. The following items should be developed in establishing the WBS:

- The major end items or products needed to accomplish contract/agreement objectives.
- The detailed tasks (all phases of the contract necessary to achieve the end products).
- The interrelationship between tasks and subtasks to provide visibility for goals and objectives.
- Organizations and responsibilities for specific projects.
- A framework for the planning, scheduling, and resources required for the work.
- A structure for the orderly summarization of work performance and progress.

A sample WBS for an example contract is shown in Figure 2-4.

b. Cost/Schedule Control. Typical cost/schedule control can be accomplished by one of the following methods: Summary, Detail by WBS, by Cost Element, and Construction Elements. A description of the various methods can be found in the DOE uniform contractor reporting system guidelines. The preferred method is "Detail by WBS" which addresses each task element, project phase or other work element required by the WBS and is time-phased by month or quarter, etc., showing the contractor's proposed expenditures.

As a minimum for establishing cost and schedule control, the following elements are necessary: an interrelated set of WBS elements, task and subtask descriptions, flow charts and graphs coupled with regular program reviews and fiscal data provided through the Financial Management Plan.

The visibility provided to the contractor project manager through the cost/schedule control system coupled with a cost management reserve that can be maintained in the cost plan provides a method by which the contractor project manager can re-allocate costs/resources to resolve problem areas. Early problem recognition allows management to re-evaluate the established priorities and take the necessary corrective action either through re-allocation of cost/resources or using the management reserve to augment weak areas.

2. Financial Management

A financial management system for resource management and financial reporting will be used for all T&A tasks. The Financial Management Plan consists of two major elements: 1) the Cost Plan, and 2) the Status/Reporting System. The combined elements provide the contractor project manager a cost management system that:

- o Establishes project-baseline budget WBS-related
- o Time-phased budget allocations commensurate with project Plan.
- o Establishes manpower requirements time-phased with Project Plan.
- o Provides for management reserve (at contractor project manager discretion).
- o Provides project cost and progress visibility with:
 - Timely budget/cost inputs.
 - Expedient cost problem identification.
 - Audited accounting data.

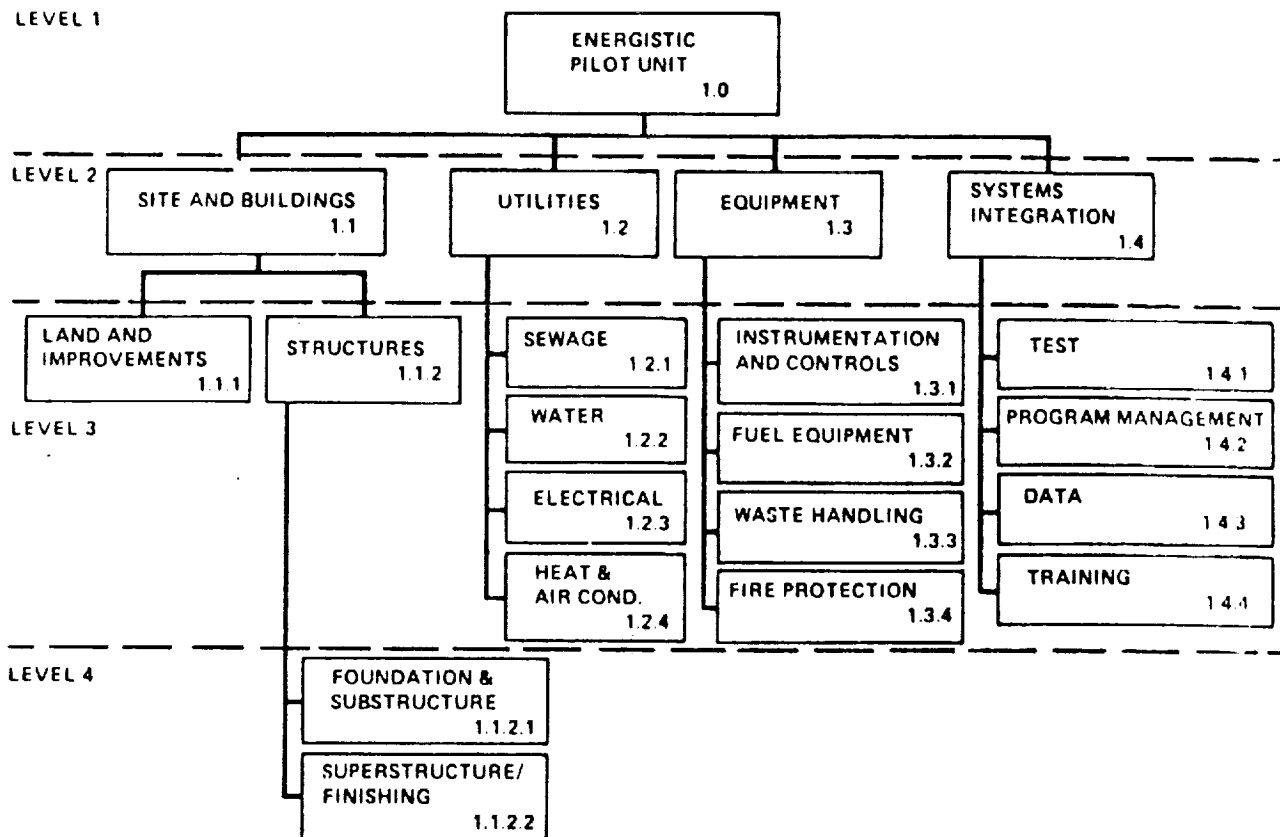


Figure 2-4. Sample Work Breakdown Structure.

NOTES:

Typically, the number of levels required depends on the scope and complexity of the contract/agreement. Each descending level represents an increasingly detailed definition of the work tasks. The top levels of the work breakdown structure are subdivided as follows:

Level 1 is the project in toto; the goal or objective of the contract.

Level 2 consists of the major steps necessary for achieving the goals of the contract. Level 2 steps are designated by progressive identification numbers such as 1.1, 1.2, 1.3 and 1.4.

Level 3 outlines the major work segments (subsystems) necessary for completing level 2 tasks. It is identified by a numeric system of 1.1.1, 1.2.1, 1.3.1, 1.3.2, and so on.

Level 4 contains the work elements for achieving the tasks in level 3. Sample identification numbers are 1.1.2.1, and 1.1.2.2.

a. Cost Plan. The cost plan will show the task and subsequent breakdown into subtasks, with assigned account codes corresponding to the work breakdown structure being used. Cost estimates for each account code will include as a minimum, manpower, travel, services, procurements, and subcontracts. When the cost plan is approved by the PM it becomes the approved plan for the conduct of the task. A typical cost plan for an example program is shown in Figure 2-5.

3. Progress Reporting

Progress reporting will be required for T&A tasks and will be accomplished on a regular basis using the DOE Uniform Contractor Reporting System (UCRS) Guidelines. Figure 2-6 describes the UCRS and shows the interrelationship of the program plans and reporting requirements.

The level of detail provided by the reporting system should be sufficient to support management and control. Date requirements (plans, reports, status documents, etc.) should be judiciously reviewed and imposed only to the extent necessary to assure a high degree of confidence of achieving success, but yet avoiding excessive management costs.

a. Internal Reporting. The contractor project manager will establish an internal reporting system that will provide, as a minimum, monthly summary progress reports containing the following information:

- Milestones accomplished.
- Milestones missed/corrective action.
- Planned activities for the next period.
- Budget (plan/actuals/problems).
- Significant problems/concerns.
- Schedule and cost trends.

b. External Reporting. Progress reports to the field center will be negotiated on an individual basis as specified in the contract and will be identified on the Reporting Requirements checklist, such as Form DOE537. A typical example of a reporting requirements checklist for an example program is given in Figure 2-7.

4. Procurement

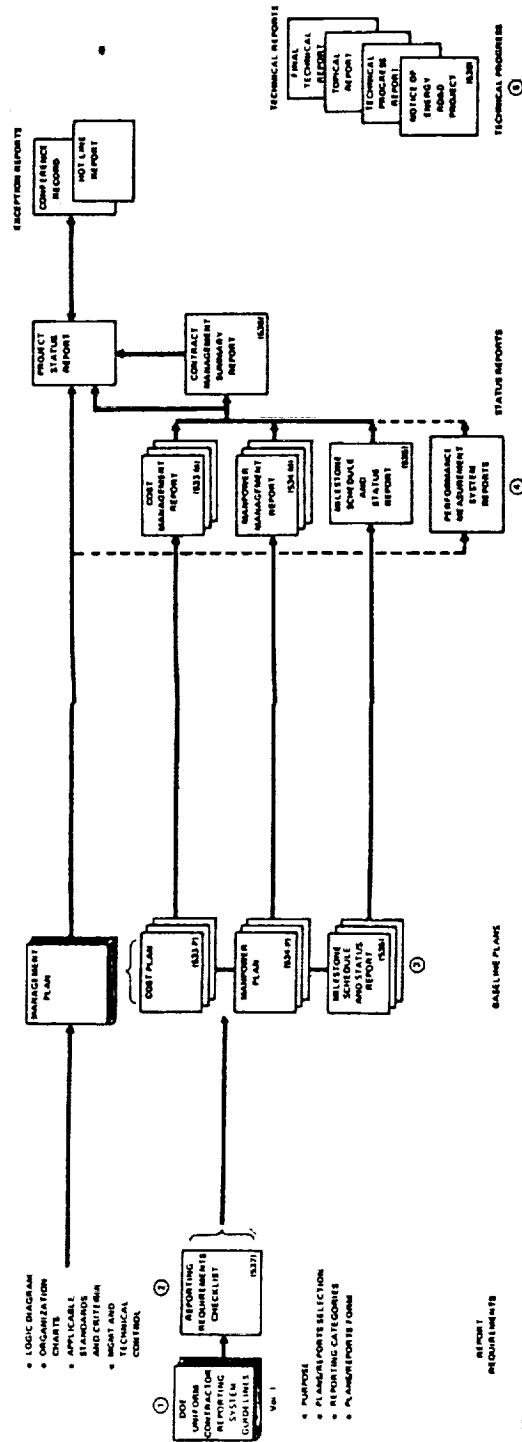
A procurement plan will be prepared identifying levels of responsibility from initiating procurement associated with T&A tasks, monitoring functions up through placement of subcontracts/purchase orders, and for contract administration activities.

U S DEPARTMENT OF ENERGY

COST PLAN

[illegible]

Figure 2-5. Cost Plan - Detail by WBS ("Clean" copy to be furnished)



B. How the Uniform Contractor Reporting System Works

- (1) The Guidelines contain the plans and reports of the Uniform Contractor Reporting System.
- (2) Before issuing a proposal request, the DOE project manager determines the information that will be required from the contractor in order to complete the proposed project. The information needs of other DOE offices, such as Finance, also will be outlined on the Reporting Requirements Checklist (Form 537). The Checklist will contain the level of detail (such as summary or by cost element) as well as the method of reporting (such as by a work breakdown structure or by contract line items). The completed Checklist is included in the Request for Proposal package to inform the contractor on what management information will be expected, how often the plans and reports should be submitted, and to whom they should be sent. After negotiation with the contractor, the Checklist becomes part of the contract.

(3) The Management Plan (including baseline plans) is submitted with the contractor's proposal and is updated soon after contract award, if required. The Management Plan is the contractor's form of a master plan of how the project will be executed. It will contain the cost, manpower, and schedule plans. It serves as the base against which progress will be measured for the life of the contract.

(4) Status reports will be required of the contractor on a regular basis. They relate directly to the baseline plans and show project progress as well as any problems in terms of cost, manpower, and schedule performances. Performance Measurement System reports, utilizing earned value data, will be used on selected contracts.

(5) The Uniform Contractor Reporting System also calls for technical and exception reports on both a regular and an as-required basis. The technical reports are for those DOE projects of a technical or scientific nature and are the primary means by which DOE disseminates scientific and technical information developed under DOE sponsored efforts to the scientific, technical and industrial communities and to the general public. The exception reports are used to report specific events or occurrences.

Figure 2-6. How the Uniform Contractor Reporting System Works.

FORM DOE 537
(1/78)U. S. DEPARTMENT OF ENERGY
REPORTING REQUIREMENTS CHECKLIST

(See Instructions on Reverse)

FORM APPROVED
OMB NO. 38R 0190

1. IDENTIFICATION Energetic Pilot Unit		2. OBLIGATION INSTRUMENT		
3. REPORTING REQUIREMENTS				
A. PROJECT MANAGEMENT 1. <input checked="" type="checkbox"/> Management Plan 2. <input checked="" type="checkbox"/> Milestone Schedule & Status Report 3. <input checked="" type="checkbox"/> Cost Plan 4. <input checked="" type="checkbox"/> Manpower Plan 5. <input checked="" type="checkbox"/> Contract Management Summary Report 6. <input checked="" type="checkbox"/> Project Status Report 7. <input checked="" type="checkbox"/> Cost Management Report 8. <input checked="" type="checkbox"/> Manpower Management Report 9. <input checked="" type="checkbox"/> Conference Record 10. <input checked="" type="checkbox"/> Hot Line Report		Frequency XO XOCQ XOYC XOYC M M M M A A	B. TECHNICAL INFORMATION REPORTING 1. <input checked="" type="checkbox"/> Notice of Energy RD&D Project (SSIE) 2. <input checked="" type="checkbox"/> Technical Progress Report 3. <input checked="" type="checkbox"/> Topical Report 4. <input checked="" type="checkbox"/> Final Technical Report C. PMS/MINI PMS 1. Cost Performance Report <i>Format 1 WBS</i> <i>Format 2 Functional</i> <i>Format 3 Baseline</i> <i>Format 5 Problem Analysis</i> 2. Cost/Schedule Status Report 3. Management Control System Description 4. Summary System Description 5. WBS Dictionary	Frequency OYC O A F
FREQUENCY CODES: A - As Required C - Contract Change F - Final (End of Contract) M - Monthly O - One Time (Soon After Contract Award) Q - Quarterly S - Semi Annually X - Mandatory for Delivery with Proposals/Bid Y - Yearly or Upon Contract Renewal				
4. SPECIAL INSTRUCTIONS a. Cost Plans and Cost Management Reports are to be prepared at the following levels: • Summary • Detailed • Cost Element • Construction Cost Elements b. Manpower Plans and Manpower Management Reports are to be prepared at the following levels: • Summary • Detailed • Labor Category c. The schedule for delivery of the selected reports is as specified in the Guidelines except: O - Within 30 days after contract award C - Within 30 days after negotiation change d. DOE shall have 45 days to review and comment on any draft technical report. e. DOE shall review and approve within 10 days any Journal article or conference paper prior to its publication or presentation. f. All technical reports, conference papers or journal articles must receive patent clearance prior to publication or presentation.				
5. ATTACHED HERewith: <input checked="" type="checkbox"/> Report Distribution List <input checked="" type="checkbox"/> WBS/Reporting Category <input checked="" type="checkbox"/> Work Breakdown Structure <input type="checkbox"/>				
6. PREPARED BY (Signature and date) <i>John Smith</i>		7. REVIEWED BY (Signature and date) <i>John Smith</i>		

Figure 2-7. Sample Reporting Requirements Checklist. ("Clean" copies will be furnished).

5. Project Unique Requirements

Specific project requirements associated with the T&A task should be summarized in the Program Plan. Specific requirements may include the following:

a. Industry/Contractor Agreements. It may be necessary to enter into agreements with outside industry or contractors other than on a subcontractor basis. These agreements should be documented and properly executed. The authority and responsibilities for executing such agreements should be identified.

b. Public/Government Agreements. There may be a special arrangement required with public utilities, public works or government regulatory agencies (i.e., the Environmental Control Agency) in the course of accomplishing the T&A. The necessary agreements should be documented and properly executed. The authority and responsibility for executing these types of agreements should be identified.

6. Review Program

A review program will be instituted for all T&A tasks. The reviews will evaluate all aspects of the activity that may affect the task commitments to the contractor project manager. The review program for the individual tasks (viz, design, develop, fabricate, install, etc.) shall be summarized in the management plan and reflected in the master milestone schedule. This section provides an overview of reviews that will in general apply to all T&A contracts. The review program will be prepared in accordance with Review Program guidelines.

a. General. The contractor project manager will be responsible for conducting the technical review and will ensure that his subcontractors, vendors and suppliers participate in reviews as appropriate. All reviews will be conducted at the contractor's facility or at a designated subcontractor facility, unless otherwise approved by the field center.

The review board membership will be appointed by the field center program manager and coordinated with the Lead Center. The Lead Center will assist the field center in obtaining board members as requested either by furnishing board members directly or soliciting support from other field centers.

b. Reviews. Overviews of those program reviews that will apply to most of the T&A contracts are given below:

1. Conceptual Design Review. The conceptual design review will be conducted after the accomplishment of functional analysis and preliminary requirements allocation (to operational/maintenance/training, hardware, software, facility, personnel and human factors as applicable) to determine the initial direction and progress of the contractor's systems engineering management effort in arriving at an

optimum and complete configuration. This review will normally be conducted within the first three months after formal task initiation.

The total system engineering management activity and its output will be reviewed for responsiveness to the statement of work and system requirements to provide a formal assessment before proceeding with the preliminary design.

2. Preliminary Design Review (PDR). The PDR will be a formal technical review of the basic design approved for the T&A and will be held after the accomplishment of the preliminary design efforts, but prior to start of detail design. The overall technical program risks associated with the T&A will be reviewed on a technical, cost, and schedule basis.

3. Critical Design Review (CDR). The CDR will be conducted on the T&A prior to fabrication/production design release to ensure that the detail design solutions as reflected in the specifications and engineering drawings satisfy the contract performance requirements. The overall technical program risk associated with the T&A will be reviewed on a technical, cost, and schedule basis.

4. Hardware/Site Readiness Review (H/SRR). The H/SRR will be conducted at the completion of all subassembly fabrication and site construction and prior to shipment and installation at the site to verify that 1) the equipment performs as required and 2) the as-built version is in accordance with the product baseline. This review will normally be conducted on first articles only where more than one of the same article is produced.

5. Operational Readiness Review (ORR). The ORR will be conducted upon completion of the T&A installation at the site and prior to long-term system operation to verify that (1) the installation is in accordance with the documented installation design and (2) the system is instrumented according to instrumentation requirements. The review will include verification of operational procedures, training and data acquisition.

7. MASTER MILESTONE SCHEDULE

The master milestone schedule provides the project baseline plan, establishing the contractor's schedule for accomplishing the planned events and milestones of each reporting category as noted in the contract and reflected in the work breakdown structure.

The milestone schedule will be prepared to the level of detail specified in the work breakdown structure elements and will identify each specified task, project phase, or other work element described in the WBS. Standard symbols and charting conventions for milestones and phases such as start, completion, design reviews, design and analysis phase, fabrication and installation phase, etc., will be used throughout all scheduling displays. All WBS elements shown on the milestone schedule will correlate to the top level WBS of the

management plan and the detail-level WBS in the technical plan and will be contained in a logical sequence for easy tracking. An explanatory text will define each milestone or event. A sample baseline milestone for an example contract using the DOE 535 is shown in Figure 2-8. The charting information is shown on the continuation page of Figure 2-8. The time line is shown in months and quarters, or other, covering the duration of the contract and the WBS structure elements are given as line items. These WBS elements can be traced through all facets of the management controls through the detail working level.

2-15

Figure 2-8. Sample Detailed Milestone Schedule and Status Report (Sheet 1 of 2).

PURPOSE

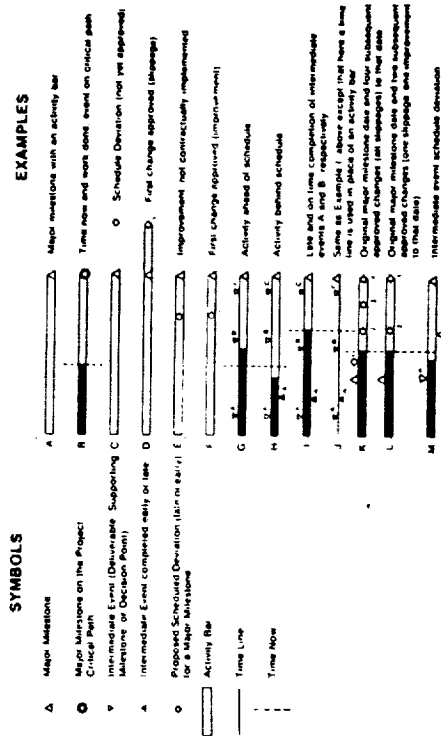
A dual purpose format to establish a baseline schedule and indicate status for performing each reporting category identified in the contract/agreement.

INSTRUCTIONS

- Item 1 - Enter the contract/agreement title as it appears in the official document establishing the contract/agreement.*
- Item 2 - Enter the inclusive start and completion dates for the reporting period for this report.*
- Item 3 - Enter the contract/agreement number as it appears in the official establishing document and append the latest modification number.
- Item 4 - Enter the name and address of the contractor, organization, or agency, as they appear in the contract/agreement.*
- Item 5 - Enter the official start date of the original contract/agreement.*
- Item 6 - Enter the official completion date, as of the latest official modification to the contract/agreement.*
- Item 7 - Enter the identification numbers relating to the contract line items, task, products, or work breakdown structure elements reported in Item 8.
- Item 8 - Enter the same contractually specified reporting categories that are on the associated Cost Plan and Manpower Plan.
- Item 9 - In the lower portion of the space for the item heading, enter the first letter of the month for the first report in the extreme left block. Enter successive months as required. Enter fiscal years in upper portion of the heading space as appropriate for months. Separate fiscal years by extending vertical line between the months of September and October. Enter schedule data below the fiscal year and month headings and to the right of each reporting category listed in Item 8. Use charting information shown at end of these instructions.
- Item 10 - Based on the contractor's best judgment, enter an assessment of actual percent complete toward meeting the objective of each reporting category listed in Item 8. The planned percent complete column is required only for construction contracts.
- Item 11 - Enter any explanatory notes and comments. If more space is required attach additional sheets and so indicate in this block. All schedule variances which exceed established contract thresholds must be explained in the Project Status Report.
- Item 12 - Enter signature of responsible contractor, agency, or organization project manager and date signed verifying the reasonableness of the information furnished, based upon his personal knowledge of the contract's progress and status.
- Item 13 - Signature of DOE Government Technical Representative and date indicating the GTR has reviewed the report. The signature does not constitute a certification of the accuracy of the report nor does it constitute any agreement with the contents of the report, or commit the Government in any way.

*These items need only be entered on the first page of multi-page reports.

CHARTING INFORMATION



CONVENTIONS

- 1 - Blacked-in figures or bars are used to show work done.
- 2 - Open figures or bars show work not done.
- 3 - Δ (Major milestone) is twice as large as ∇ or Δ (intermediate event).
- 4 - Under no condition should more than one Δ (major milestones) be shown on a single horizontal line. (See Examples D and F for a method of denoting a rescheduled major milestone Δ ; the number "1" indicates the first rescheduling.) Normally the original symbol Δ would be shown with the latest rescheduled date (a ∇ with an associated number). In certain cases, where it is desired to show a complete history of rescheduling, a series of ∇ 's with associated frequency numbers might be shown as in Example K. If it is not desirable to retain the rescheduling history DOE may request that only the current approved major milestone be shown.
- 5 - Symbols for milestones may be used alone, with an activity bar, or with a time line as the preparer judges best.
- 6 - Intermediate events may be shown only in association with an activity bar or a time line. These event symbols are placed above the bar or line and each is labeled for identification. A description of each intermediate event should be provided in an attachment to the Milestone Schedule and Status Report. One of the two methods is used to show when intermediate events are completed.
 - a - If the event is completed on time, it is blacked-in as shown above (see Example G Event A).
 - b - If the event is completed early or late, the symbol for the intermediate event is inverted (Δ) and shown below the line or activity, identified in the same way as the original. The originally planned completion date above the line is left open (not blacked-in) and the deviation to it (below the line) is blacked-in (see Example H, Event A).

Figure 2-8. Detailed Milestone Schedule and Status Report (Sheet 2 of 2).

SECTION III

GUIDELINES FOR EVALUATION OF TECHNICAL PLAN

A. TECHNICAL PLAN

The contractor will provide a technical plan that will address the T&A design, development and test; site design and construction; T&A integration at the site; operation and evaluation; and finally the site disposition. A brief task description will be provided for each major phase of the total effort. Emphasis should be placed on key items necessary to achieve the objectives that may require advancing the state of the art or similar technical or other special effort. All significant technical interfaces should be described that are necessary to accomplish the task.

B. T&A DESIGN/DEVELOPMENT

The Technical Plan will include summary descriptions and quantities of each major hardware system and subsystem, test articles, support equipment, and software for the T&A. In addition, the critical design and performance parameters should be addressed.

The approach will reflect all phases of the T&A task development, such as design, fabrication, test, quality assurance and reliability in enough depth to assure a successful development program. The major events, phases and milestones will correspond to those shown in the master milestone schedule.

The Technical Plan for implementing the T&A design/development phase will include (either directly or by reference), but not be limited, to the following:

- Design documentation - specifications, other documents associated with the given task.
- Design standards - materials, fasteners, packaging and cabling, hardware, electronic/electrical parts.
- Quality Assurance provision - see Volume I, Quality Assurance Criteria.
- Reliability and safety considerations.
- Environmental program/test criteria.

C. INSTALLATION

The contractor will prepare an installation plan describing those events necessary to prepare the T&A installation site and will use the Environmental and Siting Criteria, Volume III, as appropriate. The plan will include site considerations, site design and construction, instrumentation for monitoring, and data acquisition. Total site

preparation will be considered to the point of integrating the T&A at the site. The plan will identify major phases associated with the site preparation, and those events and milestones will be reflected in the master milestone schedule. The plan should include (either directly or by reference), but not be limited to, the following:

1. Site Consideration

- Geographical - the geographical location should consider the performance and economic viability of available solar energy. Other considerations should include (but not be limited to) potential usage, both commercial and residential.

- Geological - adaptability of the local terrain to the particular T&A should be considered. Also, earthquake faults, flood control (or potential flood conditions) or other natural catastrophic conditions should be considered.

Environmental - local natural environments such as wind, rain, hail, snow, humidity, etc., that would impact the site and/or T&A for design and/or operational considerations should be addressed.

Social/institutional - consideration should be given to impact of the site and T&A on the community aspects and implications of the activity, including potential impact of lifestyle. Availability of community resources and the ability for community involvement is a consideration. Legal/institutional aspects associated with regulatory agencies and organizational requirements should also be addressed.

Economic - economics is a strong consideration in site selection, construction and operation both for the total T&A and the local community with respect to resources available. These items should be considered and addressed in the plan.

2. Site Preparation

- Survey - a survey should be conducted and a layout accomplished to best utilize the site and take full advantage of available solar energy. The survey should include the necessary inputs from the applicable agencies and should comply with local and other regulations. The survey should address the trade-offs considered and establish the plot plan for the site.

Design - The design will utilize the survey in establishing requirements for the T&A installation and site location. All aspects of the design will comply with local, state, and other regulatory agencies for both technical and aesthetic considerations.

Municipalities

- County agencies

Consideration should be given to the various types of permits and/or licenses that may be required (i.e., building, business, experimental, etc.), and the various agencies that may be involved. Other agencies may have requirements for reports of applications and should be identified. A schedule identifying document flow should be included. Elapsed time from application to approval should support any planned schedules and should appear on the master program schedule as a milestone or event.

- Utilities

Agreements and/or applications with utilities should be included in the plan. Identification of special provisions and schedules of availability need to be addressed.

3. Fabrication

a. On-site and off-site fabrication should be considered. Agreements with contractors should be identified along with schedules or major events or milestones. The basic facilities, T&A installation and instrumentation should be considered as phases within the fabrication cycle.

b. Assembly/inspection

The assembly of the structure, T&A installation, and instrumentation may be accomplished off-site and/or on-site. The technical plan should describe the method of assembly selected, and the master milestone schedule should reflect event milestones. The inspection method and intervals should be identified, and compliance with county agency inspection requirements as well as contractor QA requirements should be addressed.

D. T&A INTEGRATION AT SITE

The contractor will prepare an integration plan for the T&A installation and checkout at the site. The plan will cover all of the activities necessary to install, check out and verify operation, safety, and necessary training to establish readiness for long-term operation.

1. T&A Installation

The installation design prepared by the contractor should include all interface definition and attaching hardware, subassemblies, etc., as required to accomplish the T&S installation at the site. The installation should also address instrumentation of the T&S as applicable and should interface with the instrumentation design accomplished under "Site Preparation".

2. Checkout and Operation Verification

Checkout and operations procedures should be prepared and reflected in the master milestone schedule. These procedures should fully address checkout of the total T&A installation and allow for operation/performance verification.

3. Safety

A safety plan will be prepared by the contractor covering all aspects of site safety for T&A operation, checkout, maintenance, and start-up and shut-down as applicable and will be prepared in accordance with the Safety Criteria Document, Volume V. The Safety Plan will include a failure modes and effects analysis covering all possible conditions.

4. Training

A training program will be prepared by the contractor that will include the necessary manuals, etc., for the facility over a long period of time. The training should include the necessary routing maintenance requirements, operation and data acquisition requirements and other items as applicable to fully qualify personnel for long-term operation of the facility.

E. OPERATIONS/EVALUATION

The contractor will prepare an Operations/Evaluation Plan for long-term operation of the facility and the necessary data management system for accomplishing performance evaluation. The following items should be considered in the plan:

1. Schedule

A complete schedule showing operation maintenance, data acquisition, etc., for the total operation period will be prepared.

2. Maintenance/Logistics

Maintenance and logistics support requirements will be included in the plan. Level of maintenance and skill level will be identified. The necessary parts lists and availability will be an integral part of the maintenance program. These items should be addressed in the Operations Plan.

3. Data Management

A section of the Operations Plan will address data management. It will describe data acquisition, reduction, and performance evaluation techniques. The Data Requirements Criteria document and the Data Acquisition and Reduction Criteria document will be used as a guide. The data management section should include (but not be limited to) the following items:

- Data acquisition - A complete description of the data to be acquired, and format, forms, etc., should be included to the detail necessary to provide an understanding of the data management mechanism.
- Data reduction/performance evaluation - Data reduction methods/techniques will be described. The necessary interfaces between data acquisition/data reduction will be identified as applicable. The performance evaluation system will be identified. Include evaluation criteria/techniques/methods, etc., pertinent to the system performance.

4. Reviews/Reports

The Operations Plan will include scheduled reviews, reports, etc., necessary to provide the processing agency with the necessary visibility of the T&A operation and performance status. The reviews and reports will be addressed in the Operation Plan and will be reflected in the master milestone schedule. Typical reporting requirements are shown in the Information Reporting Criteria document.

F. SITE DISPOSITION (CLOSEOUT)

The contractor will prepare a site disposition plan that will address the method for closing out the site either by turning over the site to the local community contractor or other organization, or by removing all facilities and T&A from the site, and restoring the site to local ecology. All aspects of site disposition will be addressed including a schedule for completion. The major events/milestones associated with site disposition will be reflected in the master milestone schedule.

